

**Part I.** Use the letter  $f$  to represent the statement “this person is female” and  $m$  for “this person is a math major.” Then we can write “this person is female or a math major” as  $f \vee m$ . Use the same idea to represent these statements – use only the basic operations *and* ( $\wedge$ ), *or* ( $\vee$ ), and *not* ( $\neg$ ).

- a. This person is female but not a math major.
- b. This person is neither female nor a math major.
- c. This person is male or a math major.

**Part II.** Let  $p$  represent the statement, “Amy is telling the truth,” let  $q$  represent the statement, “Bill is telling the truth,” and let  $r$  be the statement, “Chris is telling the truth.” Write the following three statements using propositional logic.

1. Bill or Chris is lying.
2. Chris is lying.
3. Amy and Chris are telling the truth.

Consider all possible combinations of truth values for  $p$ ,  $q$  and  $r$  in the following table form. In each case (i.e., each row), decide whether Statement 1 is true or false (use T/F for shorthand), and likewise for Statements 2 and 3.

$p$	$q$	$r$	Statement 1	Statement 2	Statement 3

Use the above information to determine if Amy, Bill or Chris (all? none?) is telling the truth given that **Amy is the one who said Statement 1**, **Bill is the one who said Statement 2**, and **Chris is the one who said Statement 3**.

### Part III. Making truth tables

1. Complete the truth table below for the statement,  $\neg(p \wedge q) \wedge (p \vee q)$  by filling in the following columns from left to right.

$p$	$q$	$p \wedge q$	$\neg(p \wedge q)$	$p \vee q$	$\neg(p \wedge q) \wedge (p \vee q)$
T	T				
T	F				
F	T				
F	F				

2. Complete the truth table below for the statement,  $(\neg p \wedge q) \vee (p \wedge \neg q)$ . You should think about what other expressions you need truth values for and fill them into the column headings left blank.

$p$	$q$					$(\neg p \wedge q) \vee (p \wedge \neg q)$
T	T					
T	F					
F	T					
F	F					

3. Complete the truth table below for the statement,  $(p \wedge q) \vee (p \wedge r)$ . You should think about what other expressions you need truth values for and fill them into the column headings left blank.

$p$	$q$	$r$				$(p \wedge q) \vee (p \wedge r)$
T	T	T				
T	T	F				
T	F	T				
T	F	F				
F	T	T				
F	T	F				
F	F	T				
F	F	F				